

maintenance or repair is best performed by the manufacturer under the operator's supervision.

(b) The manufacturer shall be permitted to observe all tests. The manufacturer shall not provide maintenance or service unless requested to do so by the operator.

#### APPENDIX A TO PART 665—TESTS TO BE PERFORMED AT THE BUS TESTING FACILITY

The eight tests to be performed on each vehicle are required by SAFETEA-LU and are based in part on tests described in the FTA report "First Article Transit Bus Test Plan," which is mentioned in the legislative history of section 317 of STURAA. When appropriate, Society of Automotive Engineers (SAE) test procedures and other procedures accepted by the transit industry will be used. The eight tests are described in general terms in the following paragraphs.

##### 1. MAINTAINABILITY

The maintainability test should include bus servicing, preventive maintenance, inspection, and repair. It also should include the removal and reinstallation of the engine and drive train components that would be expected to require replacement during the bus's normal life cycle. Much of the maintainability data should be obtained during the bus durability test at the test track. Up to twenty-five percent of the bus life should be simulated and servicing, preventive maintenance, and repair actions should be recorded and reported. These actions should be performed by test facility staff, although manufacturers should be allowed to maintain a representative on site during the testing. Test facility staff may require a manufacturer to provide vehicle servicing or repair, under the supervision of the facility staff. Because the operator will not become familiar with the detailed design of all new bus models that are tested, tests to determine the time and skill required to remove and reinstall an engine, a transmission, or other major propulsion system components may require advice from the bus manufacturer. All routine and corrective maintenance should be carried out by the test operator in accordance with the manufacturer's specifications.

The maintainability test report should include the frequency, personnel hours, and replacement parts or supplies required for each action during the test. The accessibility of selected components and other observations that could be important to a bus user should be included in the report.

##### 2. RELIABILITY

Reliability should not be a separate test, but should be addressed by recording all bus failures and breakdowns during testing. It is recognized that with one test bus it is not feasible to conduct statistical reliability tests. The detected bus failures, repair time, and the actions required to return the bus to operation should be recorded in the report.

##### 3. SAFETY

The safety test should consist of a handling and stability test. The handling and stability test should be an obstacle avoidance or double-lane change test performed at the test track. Bus speed should be held constant throughout a given test run. Individual test runs should be made at increasing speeds up to a specified maximum or until the bus can no longer be operated safely over the course, whichever speed is lower. Both left- and right-hand lane changes should be tested.

##### 4. PERFORMANCE

The performance test should be performed on the test track and should measure acceleration, maximum speed attained, gradeability, and braking. The bus should be accelerated at full throttle from a full stop to maximum safe speed on the track. The gradeability capabilities should be measured when starting from a full stop on a steep grade, and supplemented by calculating gradeability based on the acceleration data. The functionality and performance of the service, regenerative (if applicable), and parking brake systems should be evaluated at the test track. The test bus should be subjected to a series of brake stops from specified speeds on high, low, and split-friction surfaces. The parking brake should be evaluated with the bus parked facing both up and down a steep grade.

##### 5. STRUCTURAL INTEGRITY

Two complementary structural integrity tests should be performed. Structural strength and distortion tests should be performed at the Bus Testing Center, and the structural durability test should be performed at the test track.

###### *a. Structural Strength and Distortion Tests*

(1) A shakedown of the bus structure should be conducted by loading and unloading the bus with a distributed load equal to 2.5 times the load applied for the gross weight portions of testing. The bus should then be unloaded and inspected for any permanent deformation on the floor or coach structure. This test should be repeated a second time, and should be repeated up to one more time if the permanent deflections vary

significantly between the first and second tests.

(2) The bus should be loaded to gross vehicle weight, with one wheel on top of a curb and then in a pothole. This test should be repeated for all four wheels. The test verifies: normal operation of the steering mechanism; and operability of all passenger doors, passenger escape mechanisms, windows, and service doors. A water leak test should be conducted in each suspension travel condition.

(3) Using a load-equalizing towing sling, a static tension load equal to 1.2 times the curb weight should be applied to the bus towing fixtures (front and rear). The load should be removed and the two eyes and adjoining structure inspected for damages or permanent deformations.

(4) The bus should be towed at curb weight with a heavy wrecker truck for several miles and then inspected for structural damage or permanent deformation.

(5) With the bus at curb weight probable damages and clearance issues due to tire deflating and jacking should be assessed.

(6) With the bus at curb weight possible damages or deformation associated with lifting the bus on a two post hoist system or supporting it on jack stands should be assessed.

#### *b. Structural Durability*

The structural durability test should be performed on the durability course at the test track, simulating twenty-five percent of the vehicle's normal service life. The bus structure should be inspected regularly during the test, and the mileage and identification of any structural anomalies and failures should be reported in the reliability test.

#### 6. FUEL ECONOMY

The fuel economy test should be conducted using duty cycles that simulate transit service. This test should measure the fuel econ-

omy of the bus in miles per gallon or other energy-equivalent units.

The fuel economy test should be designed only to enable FTA recipients to compare the relative fuel economy of buses operating at a consistent loading condition on the same set of typical transit driving cycles. The results of this test are not directly comparable to fuel economy estimates by other agencies, such as the U.S. Environmental Protection Agency (EPA) or for other purposes.

#### 7. NOISE

The noise test should measure interior noise and vibration while the bus is idling (or in a comparable operating mode) and driving, and also should measure the transmission of exterior noise to the interior while the bus is not running. The exterior noise should be measured as the bus is operated past a stationary measurement instrument.

#### 8. EMISSIONS

The emissions test should measure tailpipe emissions of those exhaust constituents regulated by the United States Environmental Protection Agency (EPA) for transit bus emissions, plus carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>), as the bus is operated over specified driving cycles. The emissions test should be conducted using an emissions testing laboratory equipped with a chassis dynamometer capable of both absorbing and applying power.

The emissions test is not a certification test, and is designed only to enable FTA recipients to compare the relative emissions of buses operating on the same set of typical transit driving cycles. The results of this test are not directly comparable to emissions measurements obtained by other agencies, such as the EPA, which are used for other purposes.